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Engineering Note

Date: 4/26/99
Rev Date: 12/04/01

Project: Infrastructure Support
Doc. No: H011204A

Subject: Standards for Cables Used in Particle Physics Division Experiments

Conductor sizes, overcurrent protection and insulation rating shall be chosen in accordance with the document "Electrical Design Standards for Electronics to be Used in Experiment Apparatus at Fermilab". That document and the most recent version of this document is available on the web at the EED Infrastructure Group web site.

Cable types must be chosen with regard to fire safety i.e. flame propagation and smoke characteristics. Cable **must** be rated to a recognized standard that shows they are self extinguishing and will not spread a fire. Cables with low smoke density, toxicity, and corrosivity of gasses are **preferred**. Smoke produced by overheated halogenated cable insulation is corrosive to electronics. Whenever possible, cable should be specified as halogen free.

The following information was gleaned from the National Electrical Code Article 725 and other sources. Check the most recent version of this document. New types will be added as they are identified and evaluated. The PPD Division Head may grant exceptions on a case by case basis. When choosing a cable for an application listed in the "Application" column, try to choose one of the NEC cable types or permitted substitutions; or UL, IEC, or CSA Fire rating from the same row.

Table of Cable Types and Substitutions

Application	Description	NEC Cable Types	Permitted Substitution	UL Fire Rating*	IEC Fire Rating*	CSA Fire Rating*
Air ducts	Plenum	CL2P	CMP,CL3P	UL 910 (smoke and flame)	N/a	FT6
Vertical shafts	Riser	CL2R	CMP,CL3P,CL2P, CMR, CL3R	UL 1666 (Vertical riser)	N/a	
Areas other than risers or plenums	General Purpose	CL2	CMP, CL3P,CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3, TC	UL 1581 IEEE 383 (Vertical tray)	IEC 332-3	FT4
Enclosed in conduit, up to 10 feet exposed	General Purpose - Limited Use	CL2X	CMP, CL3P, CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3, CL2, CMX, CL3X, TC	UL 1581 VW-1	IEC 332-1	

* Note, The IEC and CSA Fire ratings are not necessarily represented here as equivalent to the UL Fire Ratings. The UL (US) standards are more comprehensive and stringent than their international counterparts with regard to flammability. However, the international ratings may be substituted as shown. The international ratings do imply additional safety and materials requirements.